



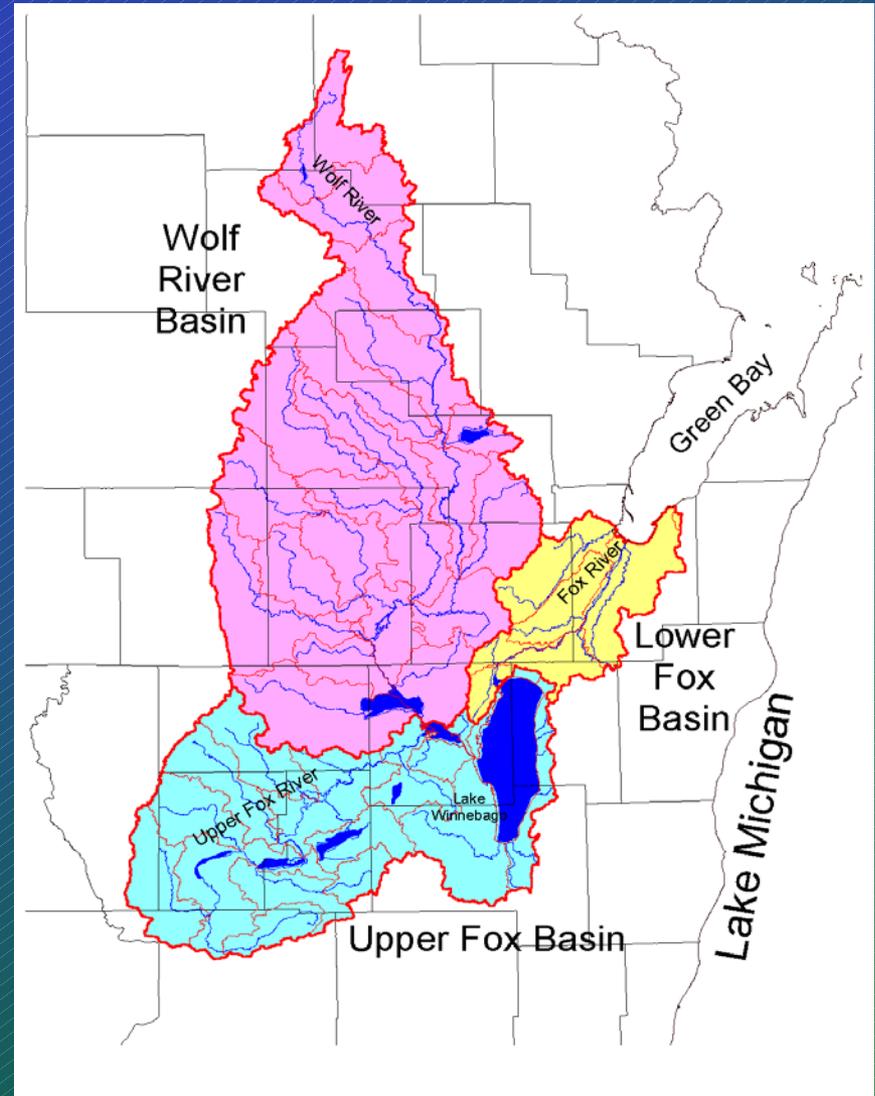
Presentation for
NOAA Great
Lakes Coastal
Ocean Program
Workshop
Jan. 20-21, 2003
~
J. Val Klump

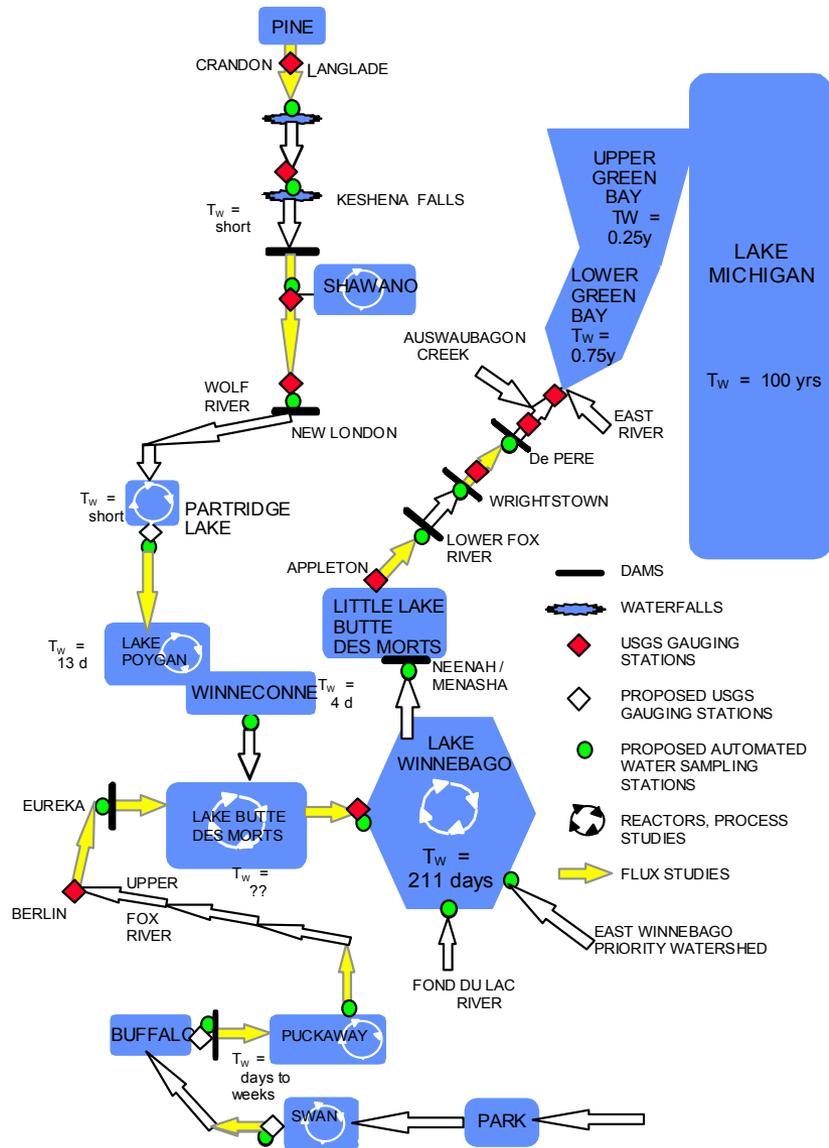
Land-margin interactions: 3 venues – subject to major Δ 's

1. watershed systems
2. boundary systems
3. coastal systems

1. Watershed systems: major changes ~

- Hydrologic modification
- Δ land uses
- Loadings



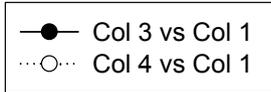
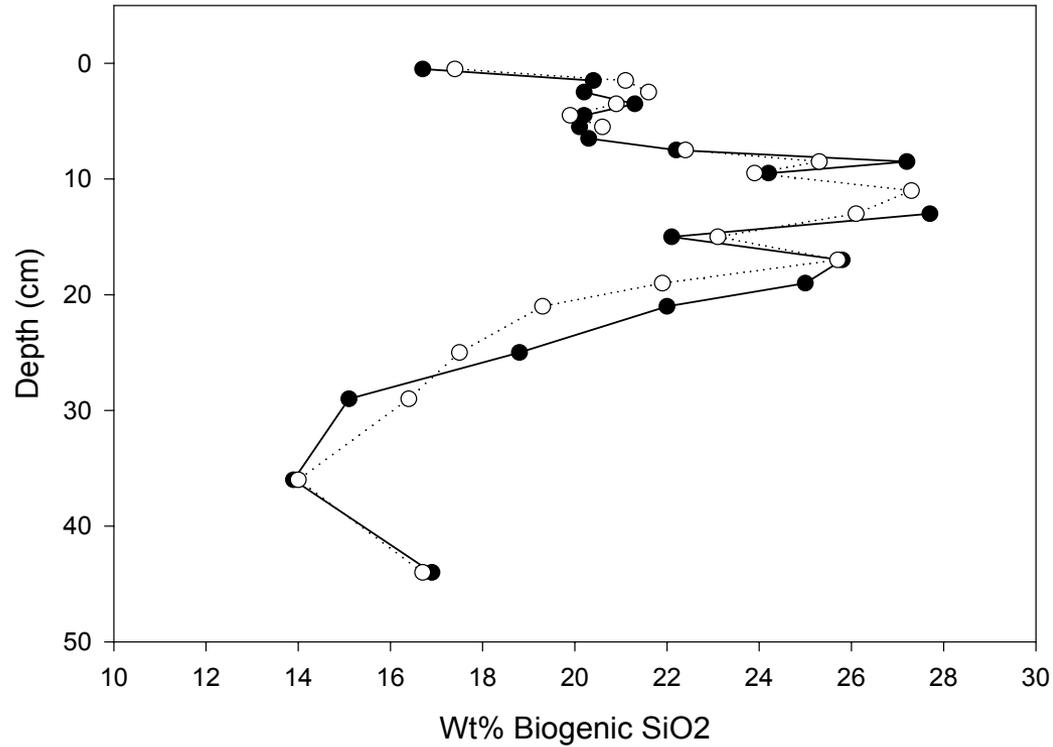


altered hydrologies

- increased residence times
- trapping and attenuation of flux downstream
- alteration of composition

How are materials transported and transformed within complex watershed systems ?

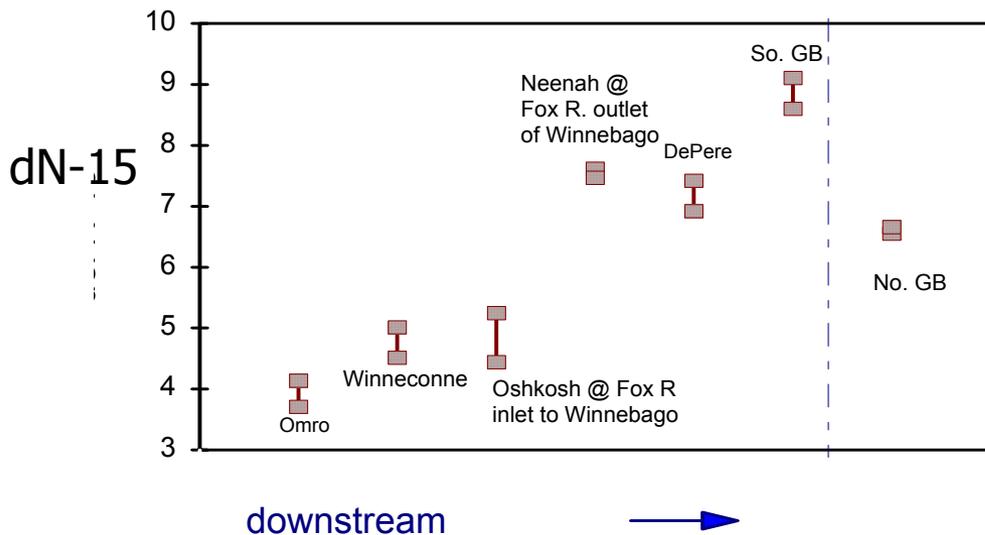
BSi in Swan Lake Sediments



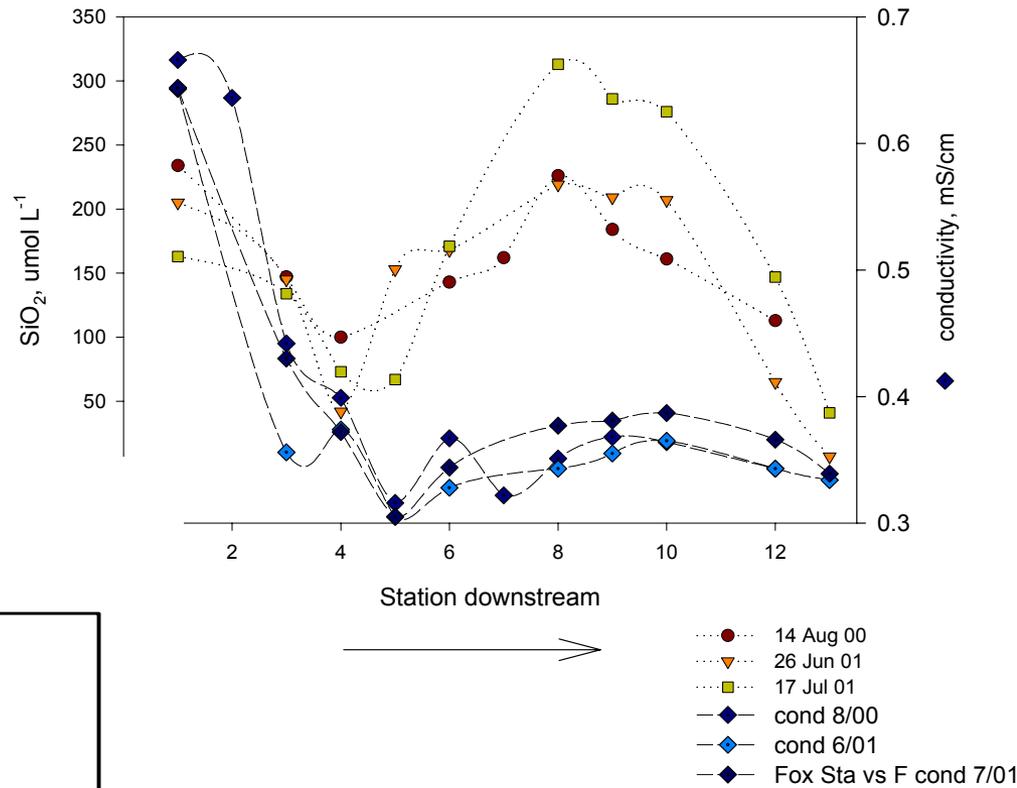
Accelerated
sequestration &
trapping in
reservoirs

Transformations in composition & mass

Figure 3. Downstream isotopic enrichment in >60 μm particulates



SiO_2 concentrations in Fox River system



Major trend = Population growth

sub-sets of this general trend =

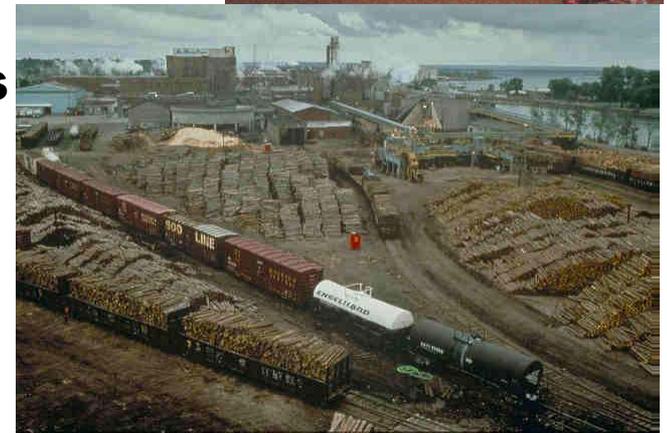
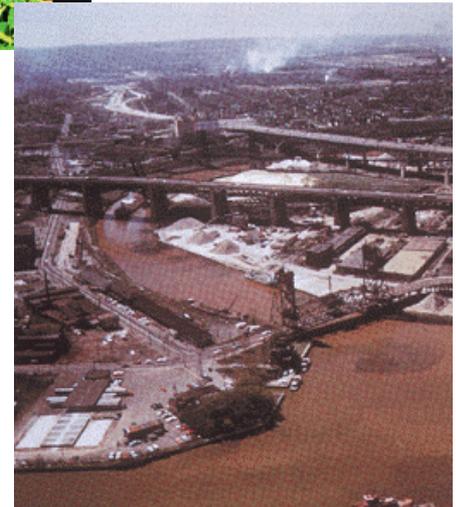
= agricultural development

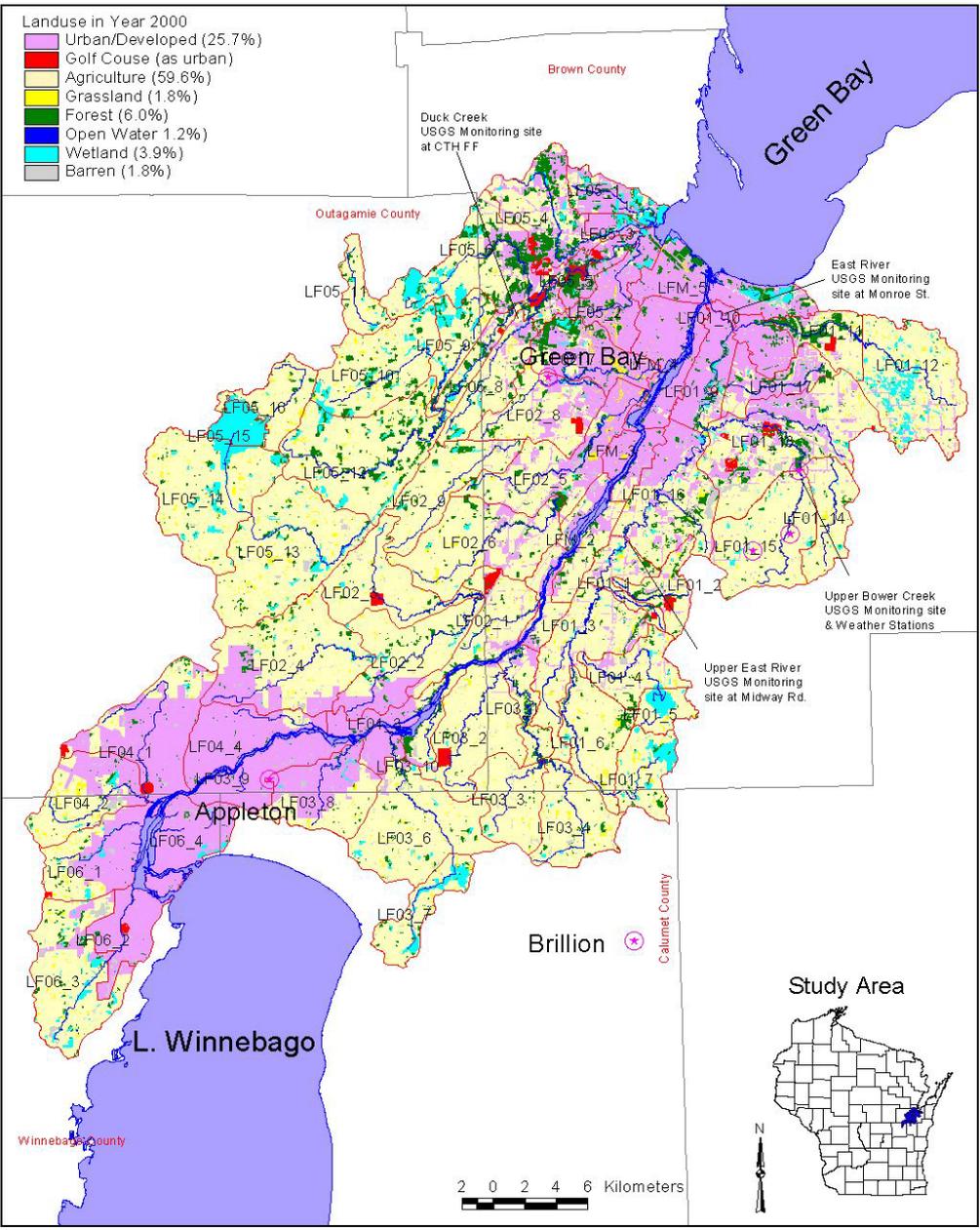
= industrialization

= urbanization -- the newest trend

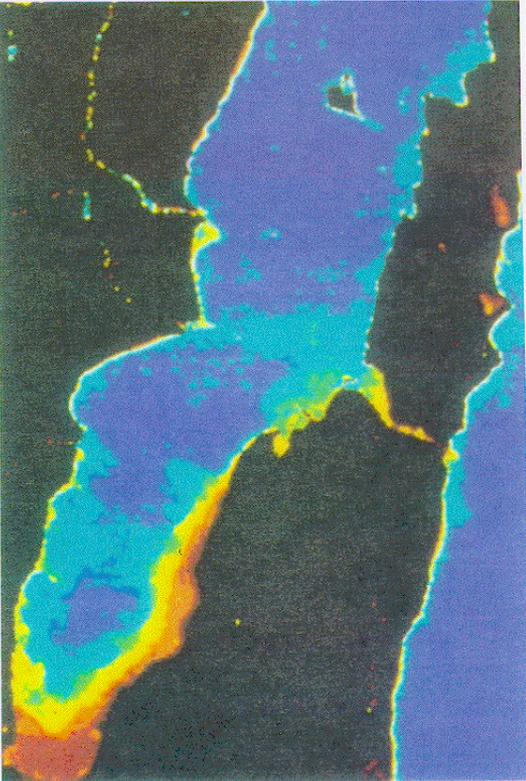
All \Rightarrow major **land use changes**
which are driving system change

- accelerated weathering & enhanced inputs of **soils, nutrients & other** by-products of anthropogenic activities

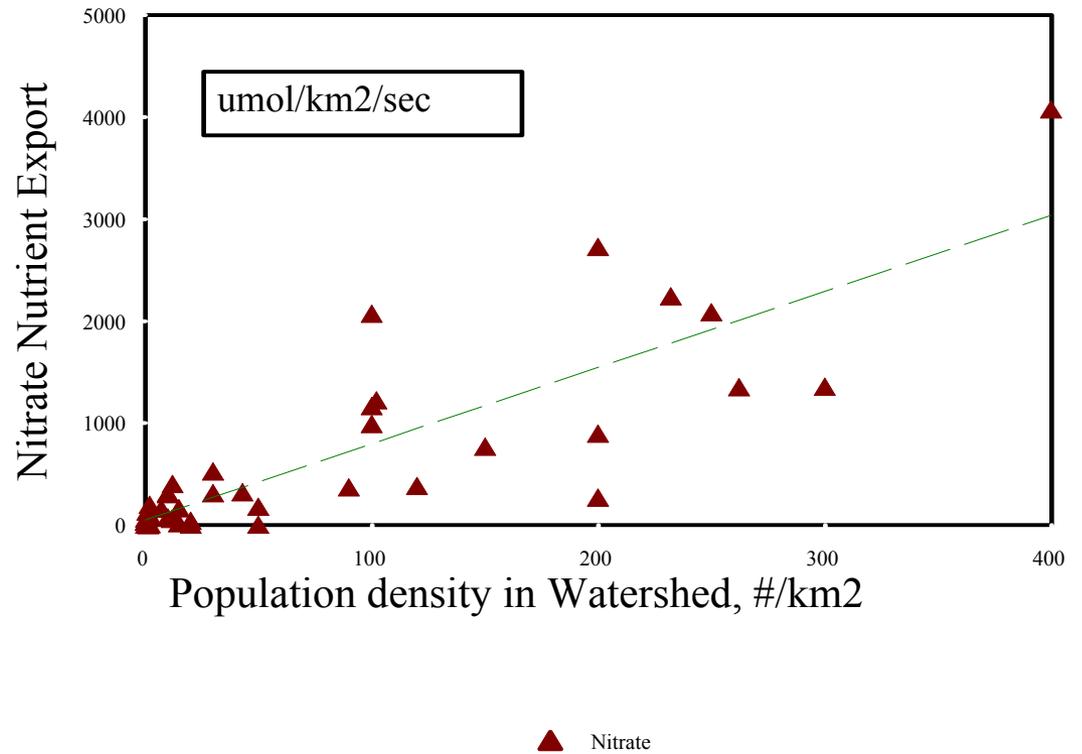




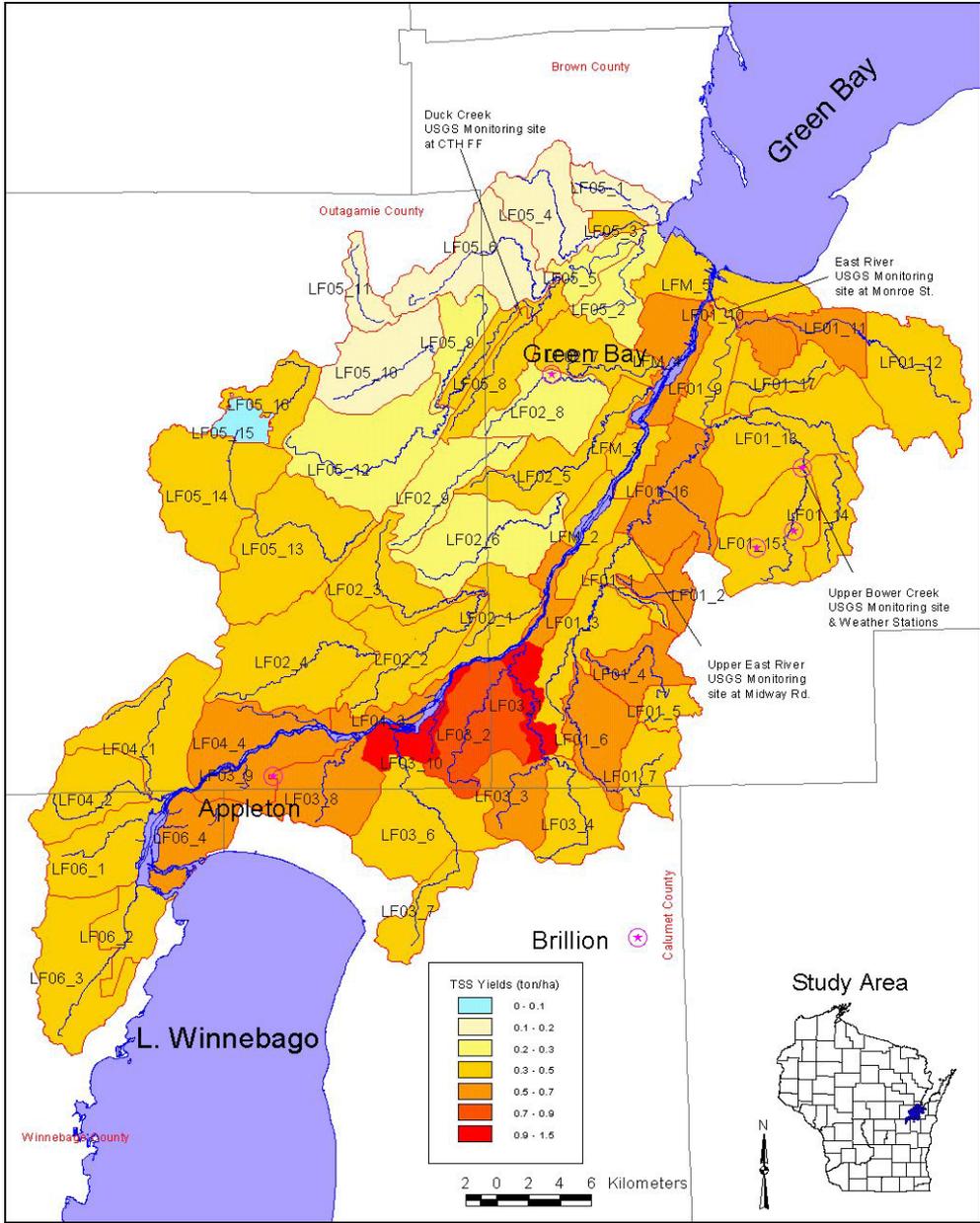
Urbanization & the urban coast

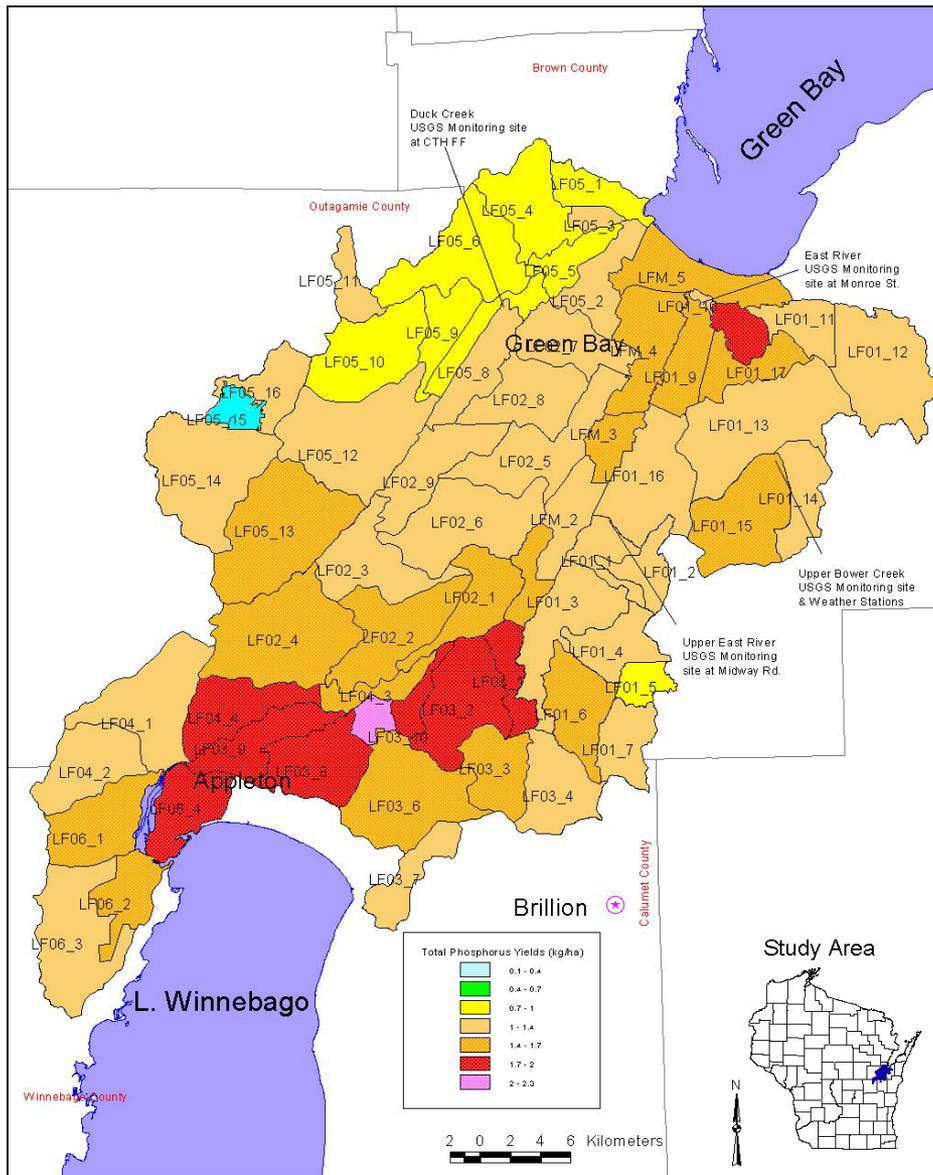


Human Population and Coastal Marine Pollution from Major Rivers



Sediment yields



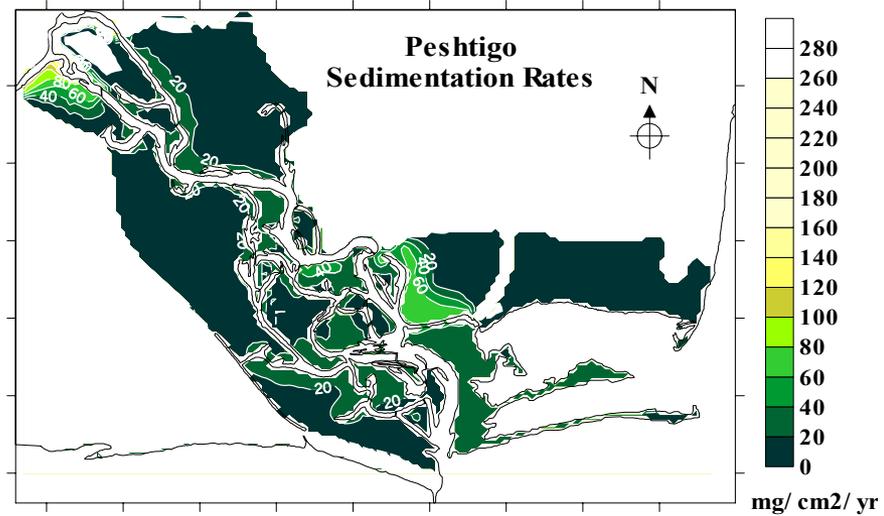
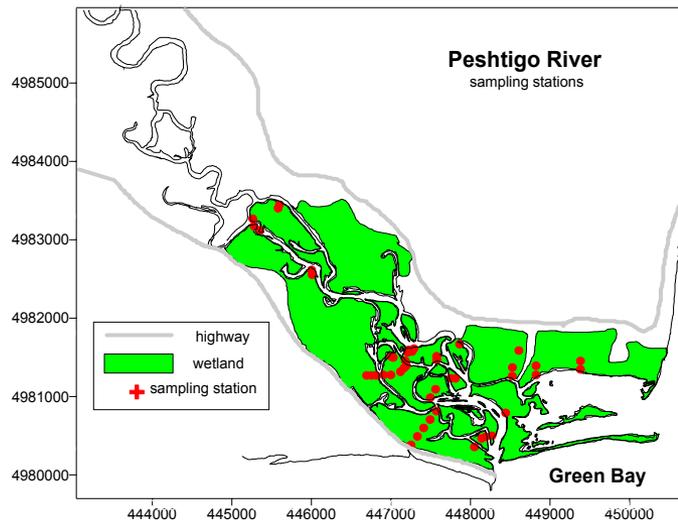


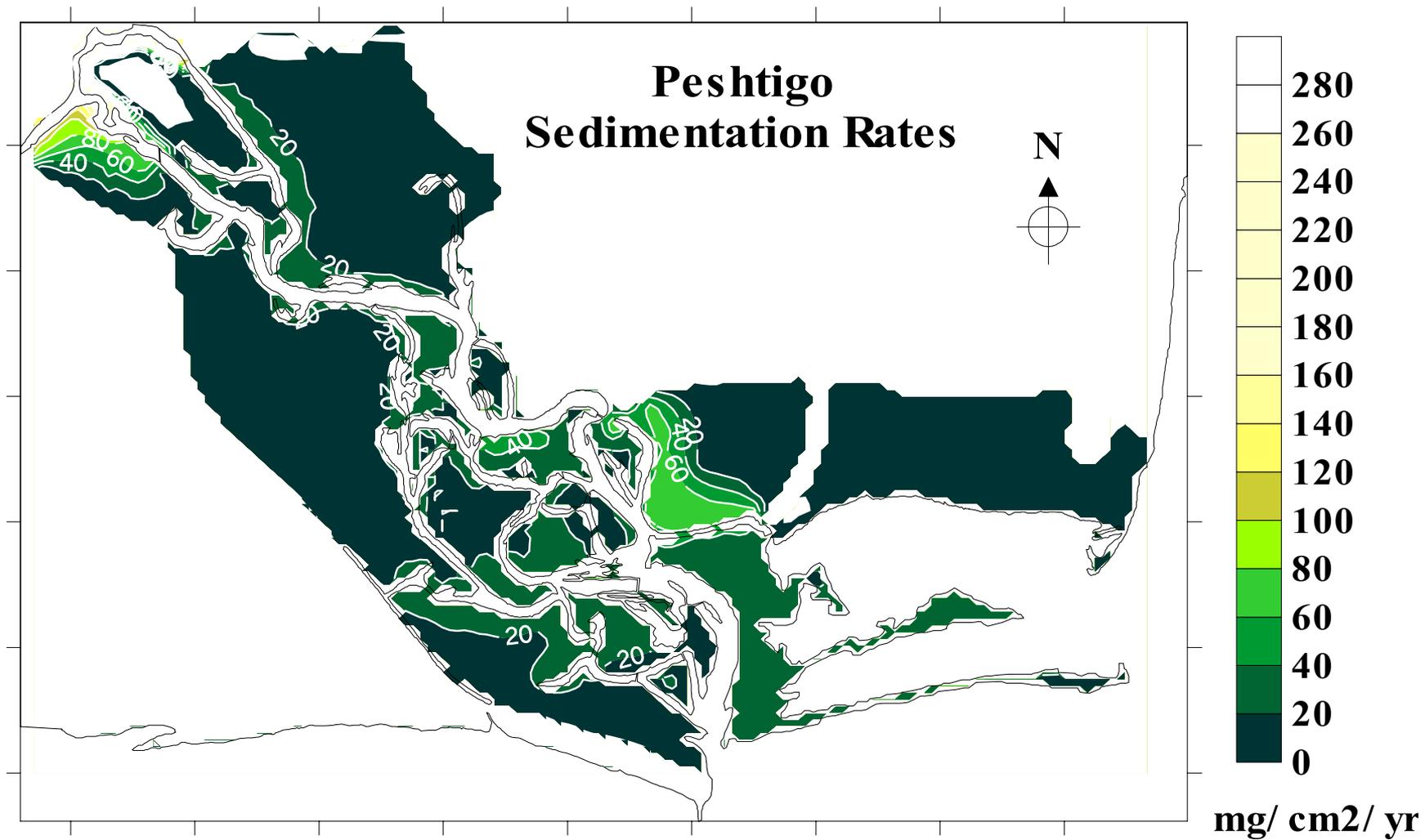
Nutrient loadings:

urban ~ rural



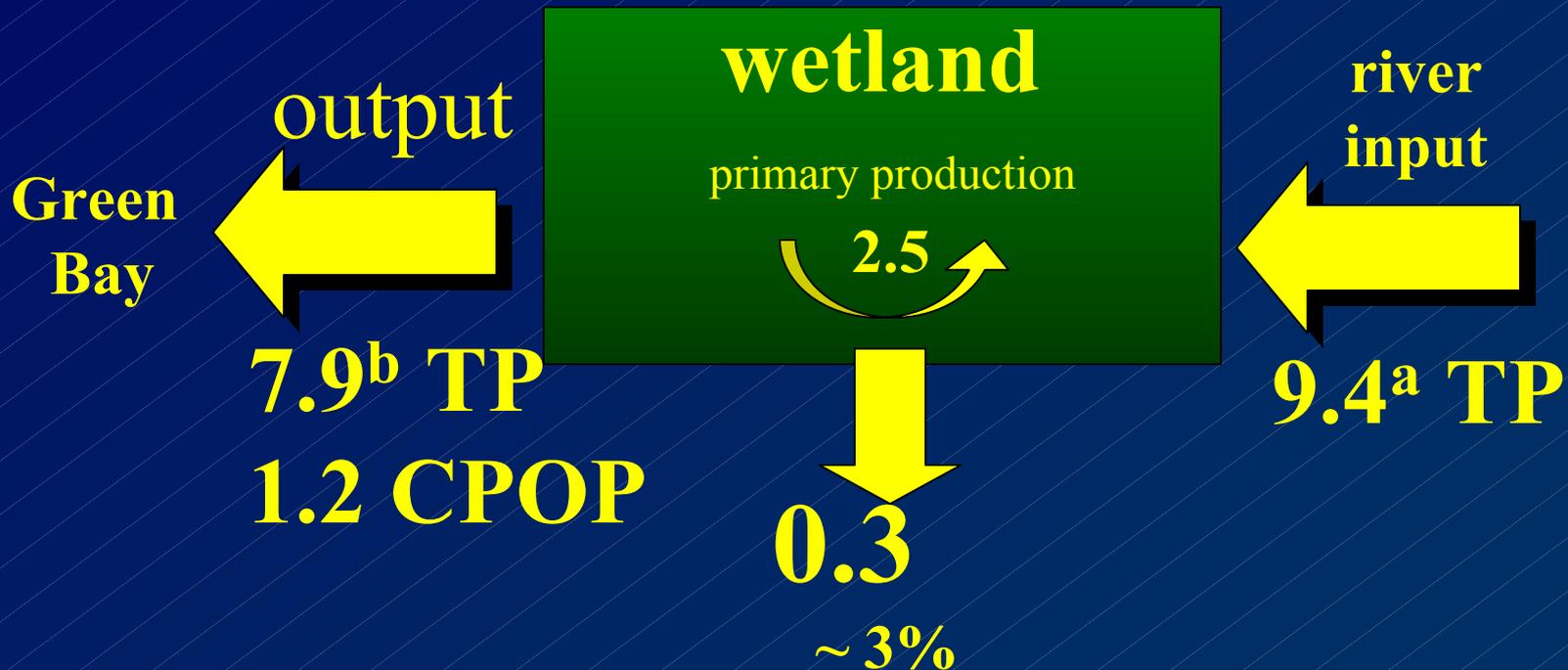
2. Boundary systems: e.g. wetlands
role in alteration of flow, fluxes, etc.





weighted $\bar{\omega} = 19.0 \text{ mg}\cdot\text{cm}^{-2}\cdot\text{yr}^{-1}$

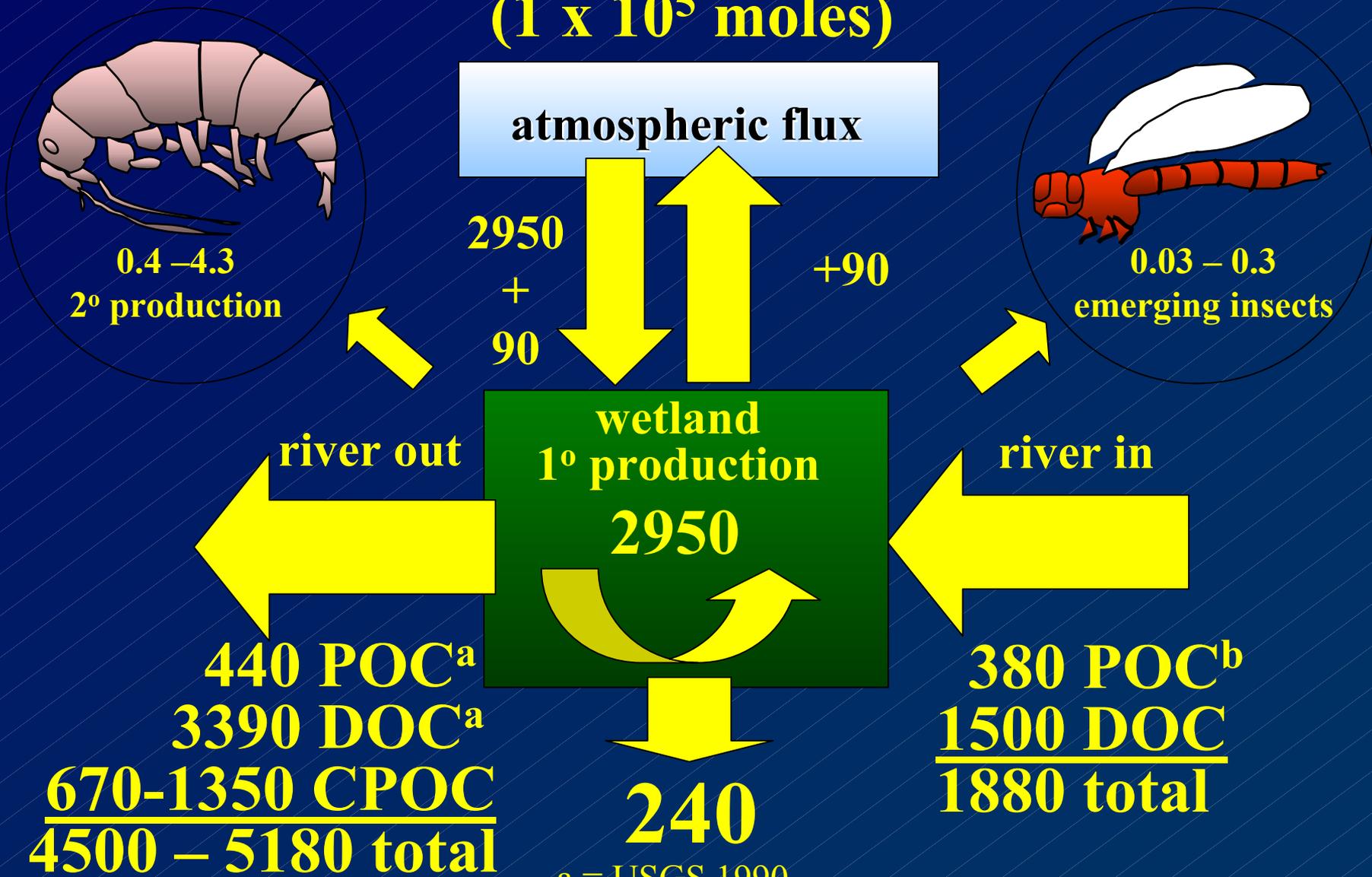
Peshtigo wetland phosphorus budget (x 10⁵ mol·yr⁻¹)



a Klump et al. 1997 (estimated from 1970-1990 flow)

b Green Bay Mass Balance (1988-1990)

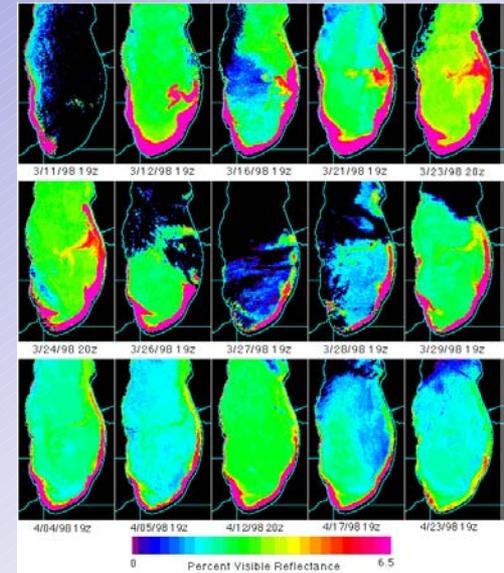
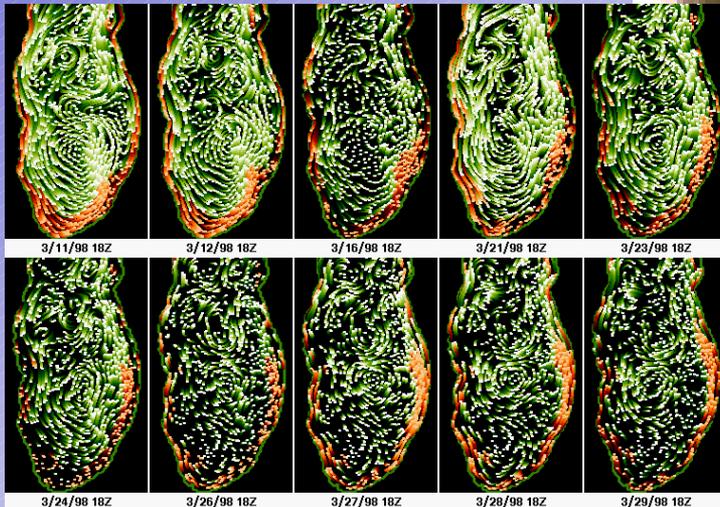
Peshtigo wetland carbon budget (1×10^5 moles)



a = USGS 1990

b = C. Tiegs, WDNR, pers. comm.

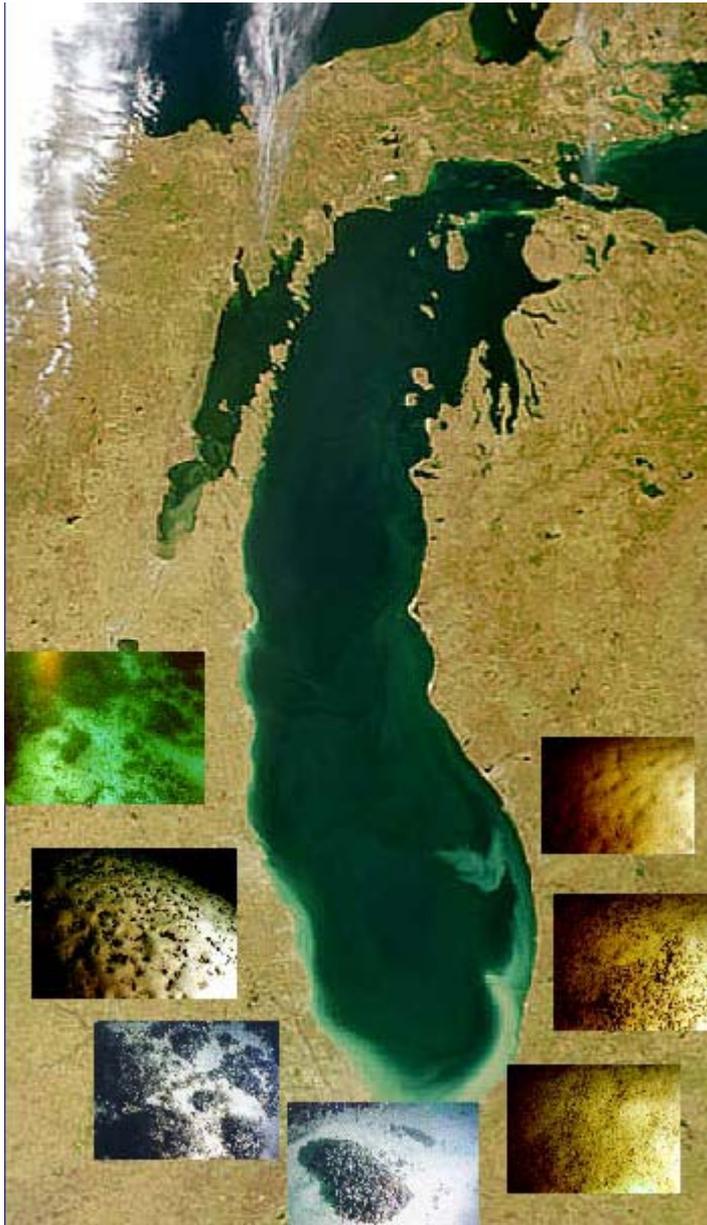
3. Coastal systems: e.g. EEGLE: Episodic Events Great Lakes Experiment



**NOAA – COP
NSF – CoOP**



**Goal = the role episodic events play in
the cross margin transport processes of
coastal ecosystems**



Coastal habitats:

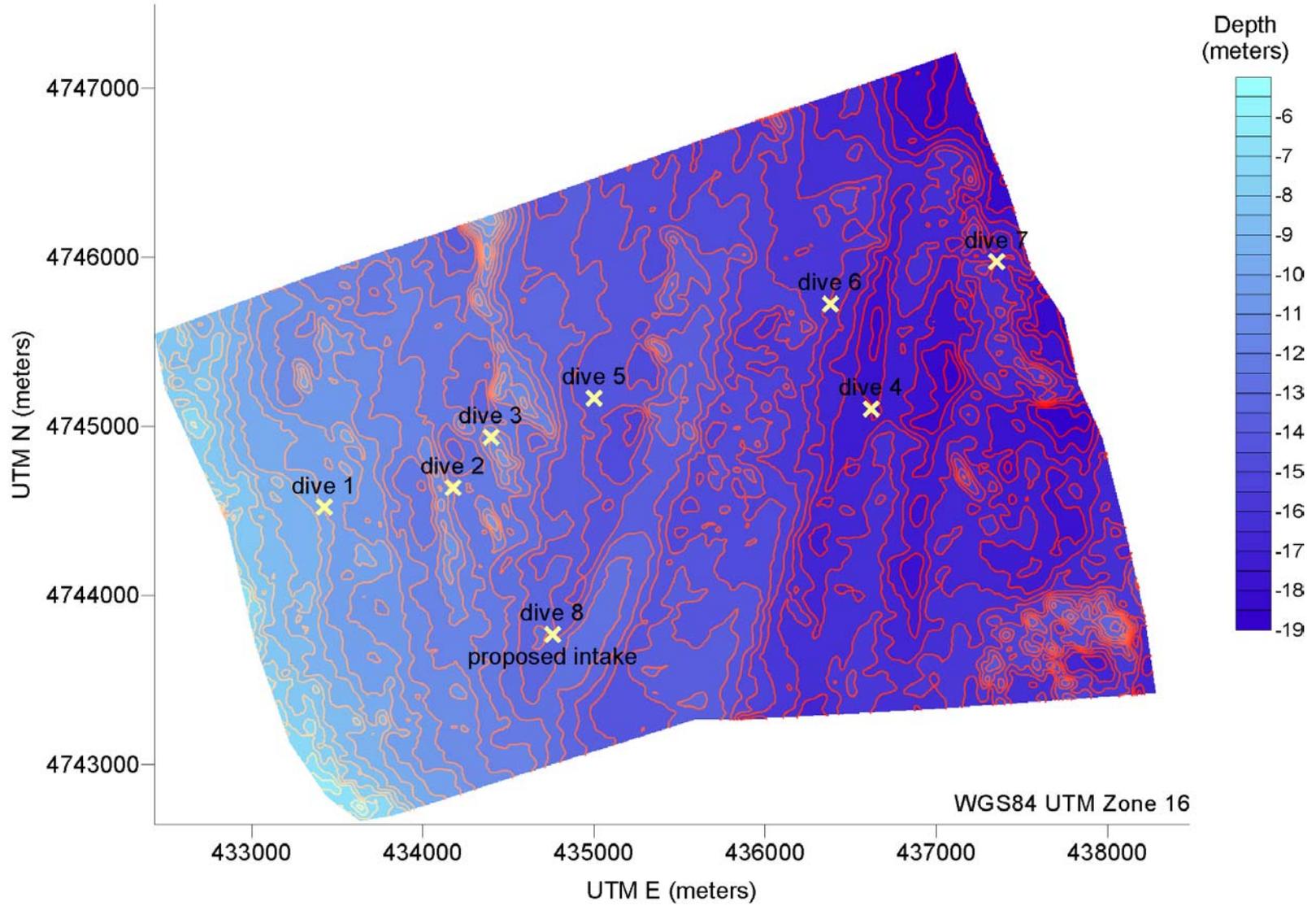
e.g nearshore hardgrounds

- highly dynamic - EEGLE
- complex topographic structure
= largely unmapped & under studied
- rapidly changing ecologies,
e.g. ZM cladophora i/a

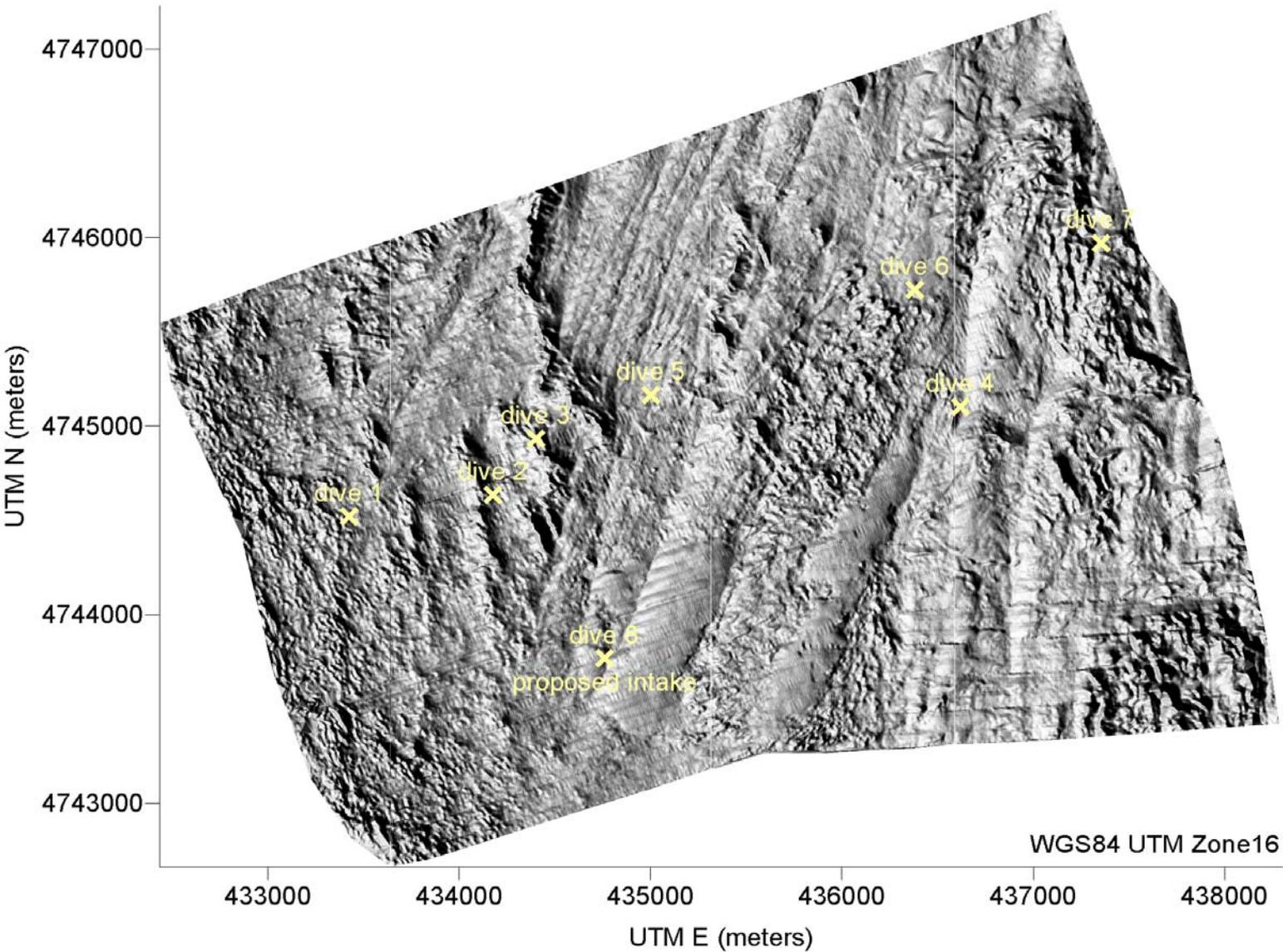
= coastal health concerns

= security issues

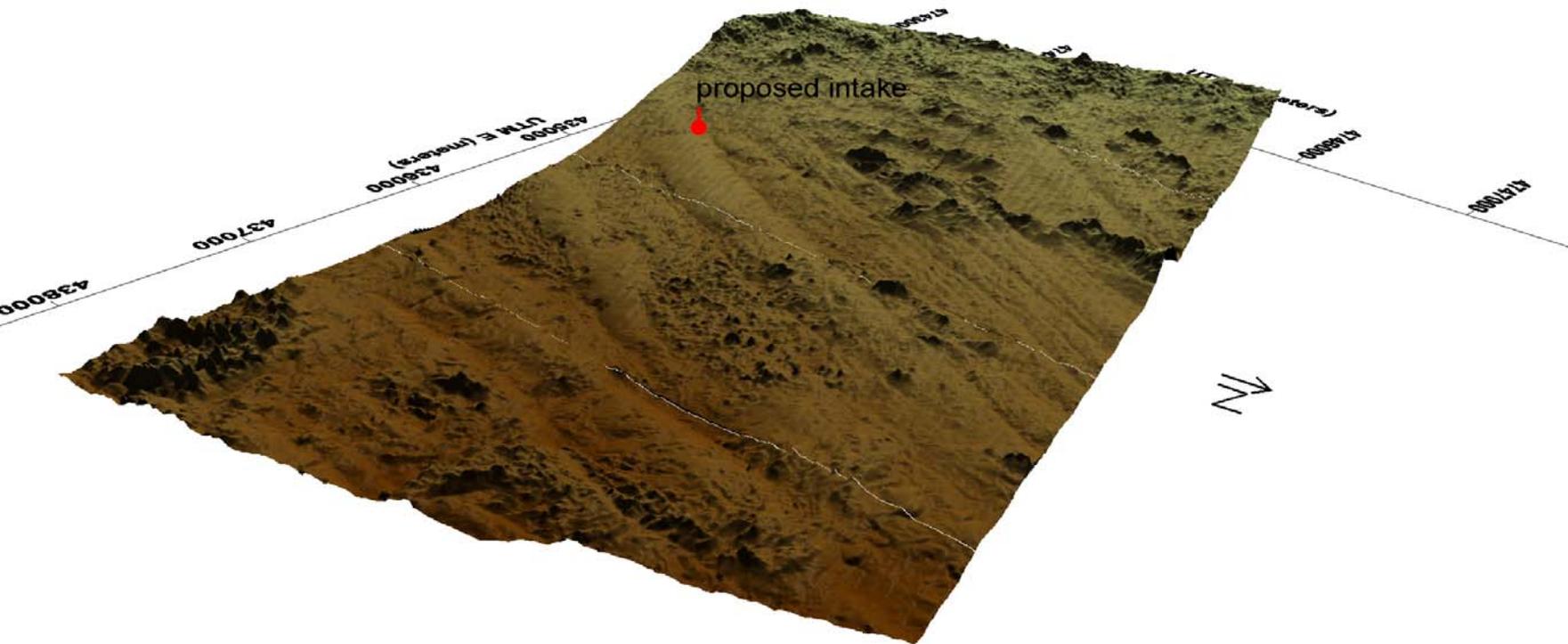
BATHYMETRY CONTOUR MAP



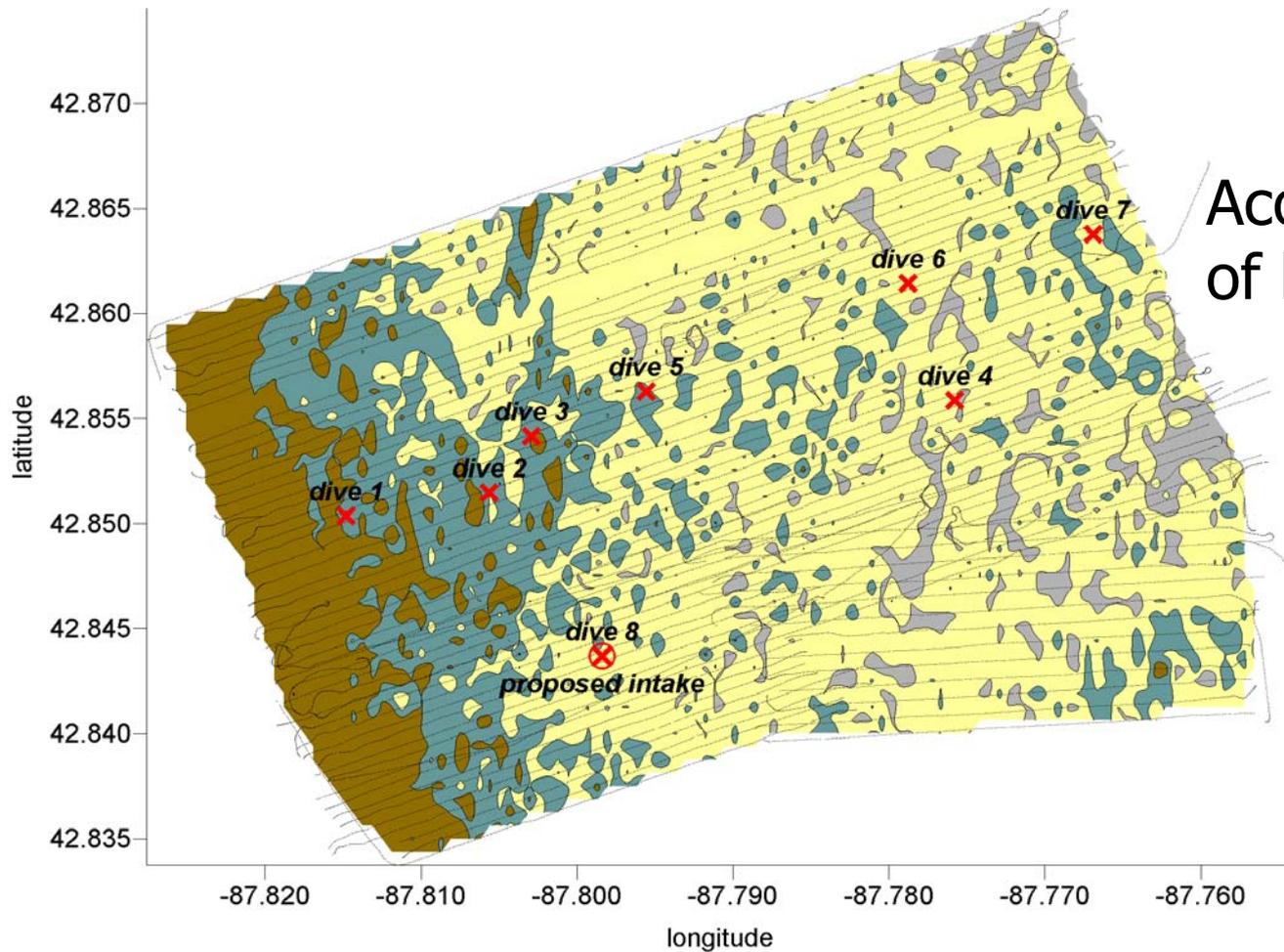
HIGH RESOLUTION SHADED RELIEF MAP



HIGH RESOLUTION SURFACE MAP

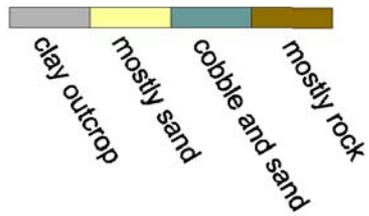


SEABED CLASSIFICATION AND SURVEY TRACKLINES

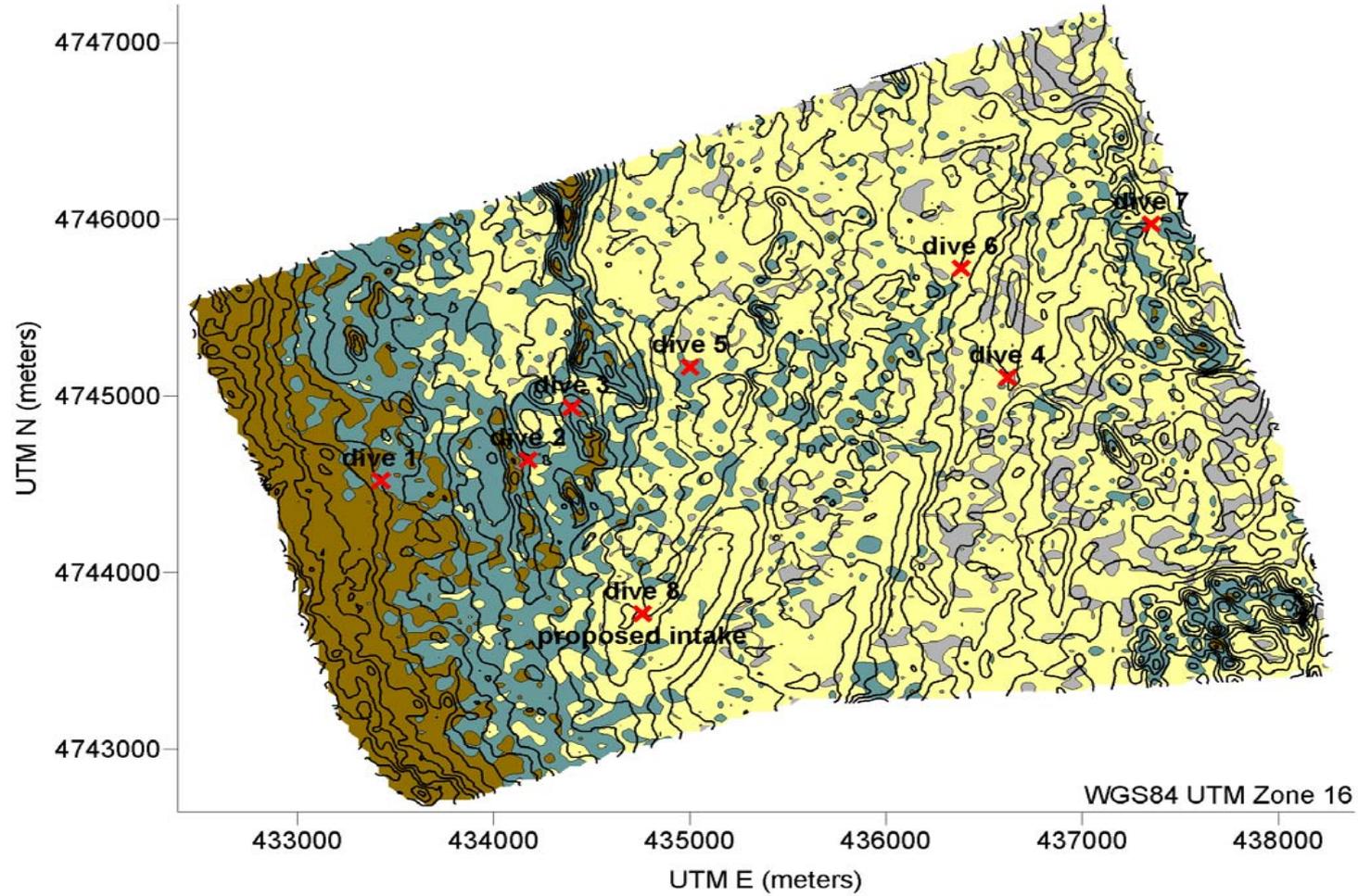


Acoustic classification
of bottom types

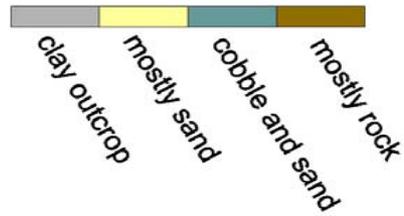
SEABED COLOR CODE



SEABED CLASSIFICATION AND BATHYMETRY



SEABED COLOR CODE





Nearshore reefs → major shift in ecology



Zebra mussels on shallow reef bottom

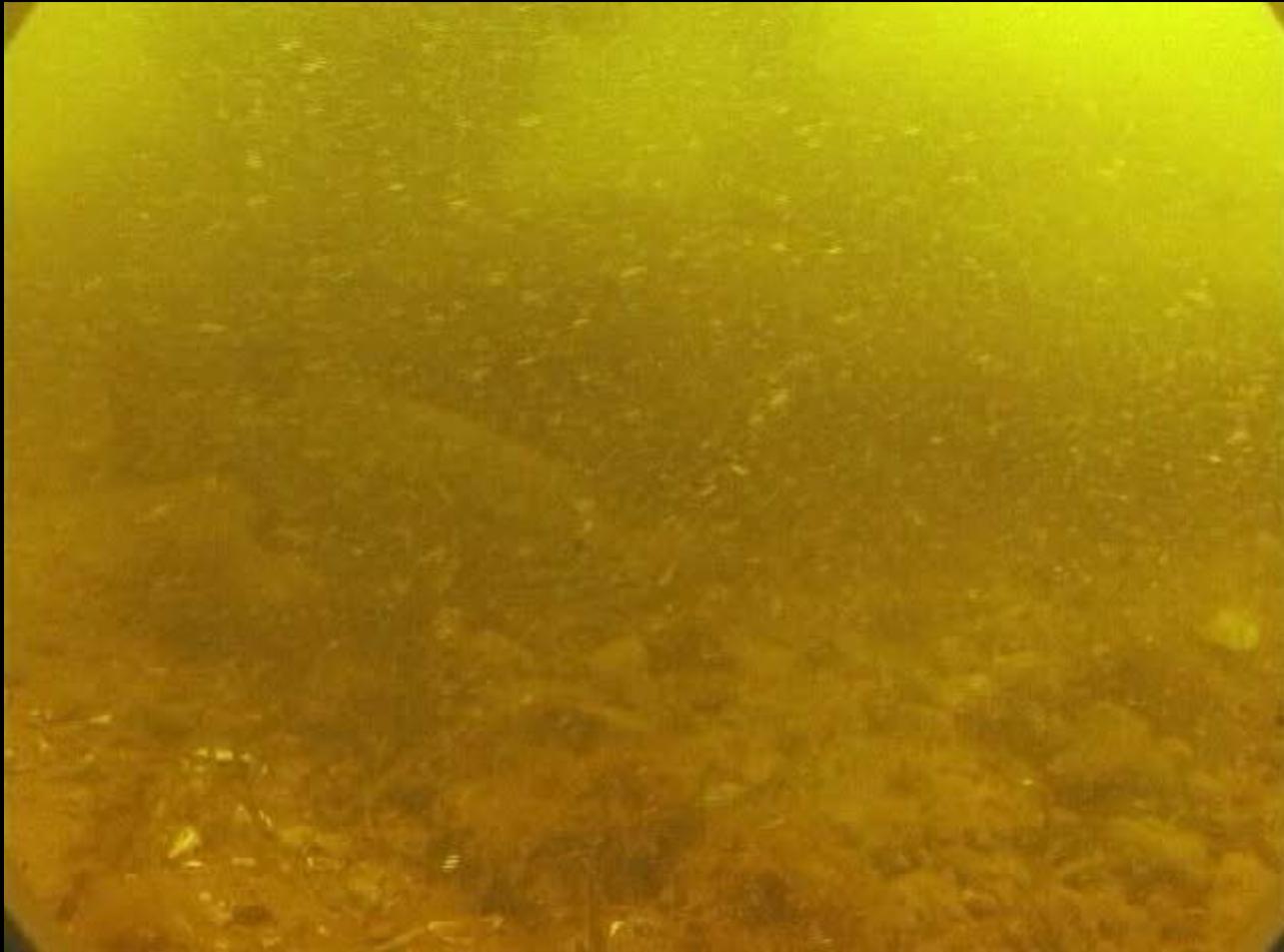


↑ ZM = ↑ light & nuts = massive “cladophora meadows”...

= impacts on perch ?

↑ viz = ↑ predation?

↑ ZM filter feeding = ↓ food supply for larval fish

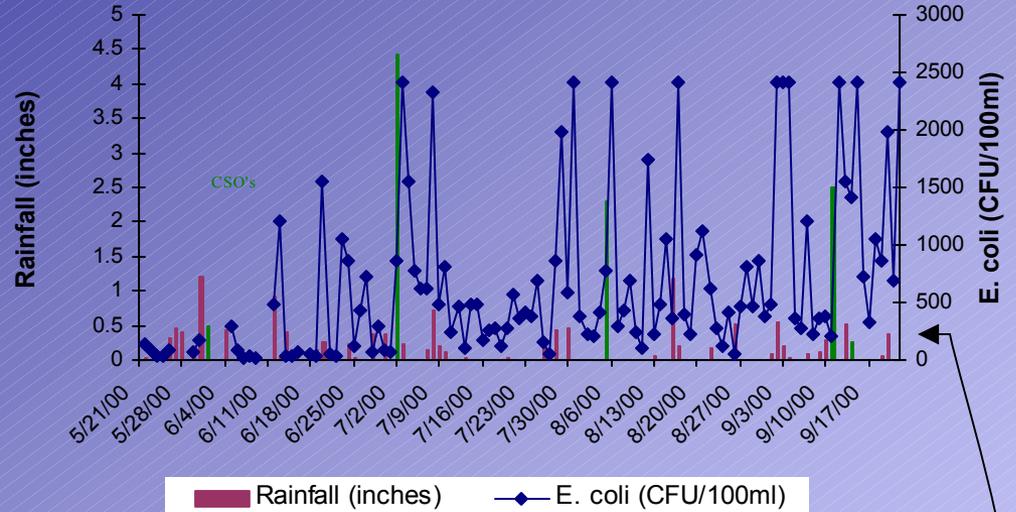
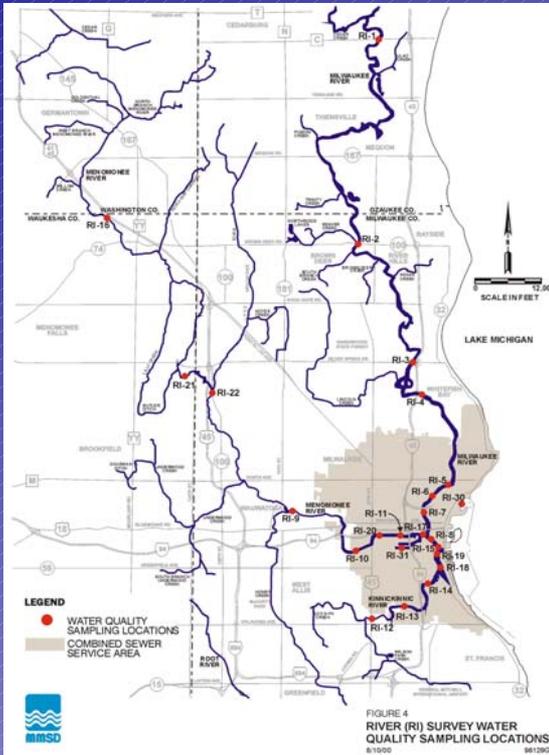


**Observation: bass defends nest of eggs...
But it gets caught... ...and a goby feeding
frenzy ensues!**

Coastal Health: e.g.

Bacterial contamination of beaches :

- numbers & types
- viability
- sources & source functions



August 23



- canoe sites
- 0 - 234
 - 235 - 500
 - 501 - 1000
 - 1001 - 2500
 - 2501 - 15000



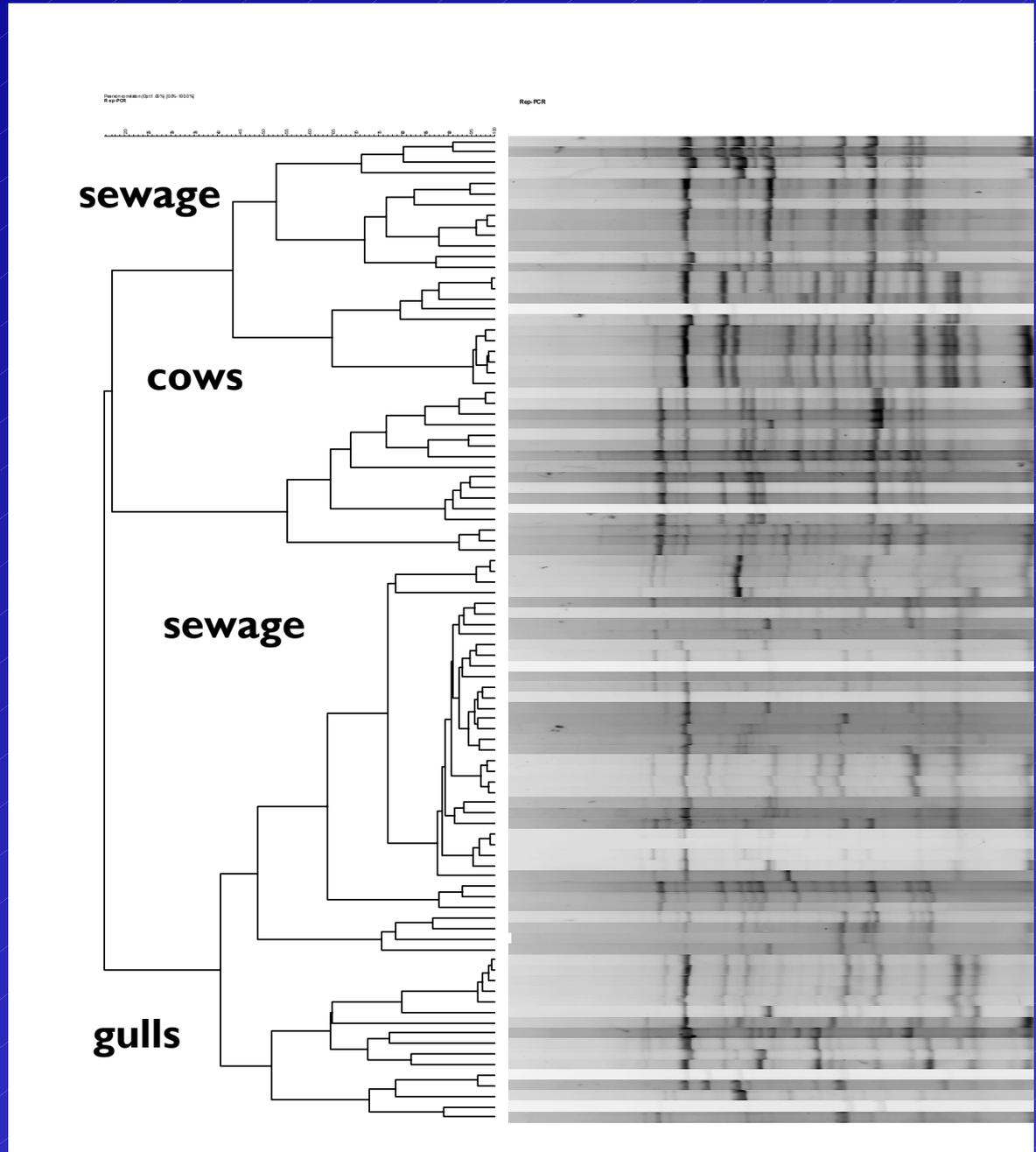
○ > 235 CFU per 100 ml



Unknown Units: August 23



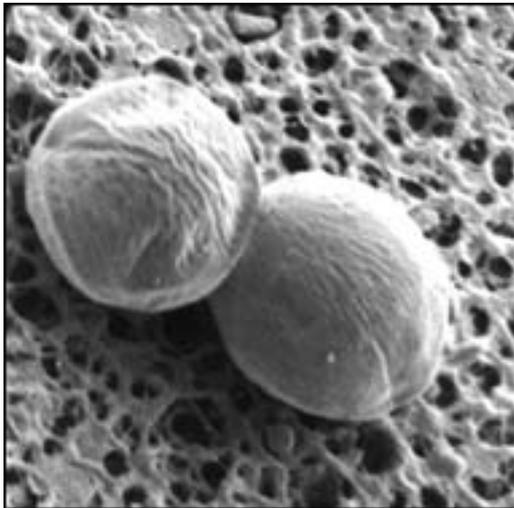
DNA Finger-Printing & Source Identification



Milwaukee learned its water lesson, but many other cities haven't

CDC Safe Water Advisory

-  Boil tap water one minute
-  Run water through fine filter
-  Use bottled water



Cryptosporidium oocysts



Morris (CNN)

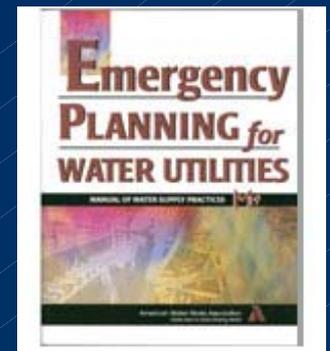
The Year That Made Milwaukee Infamous



How secure are they?

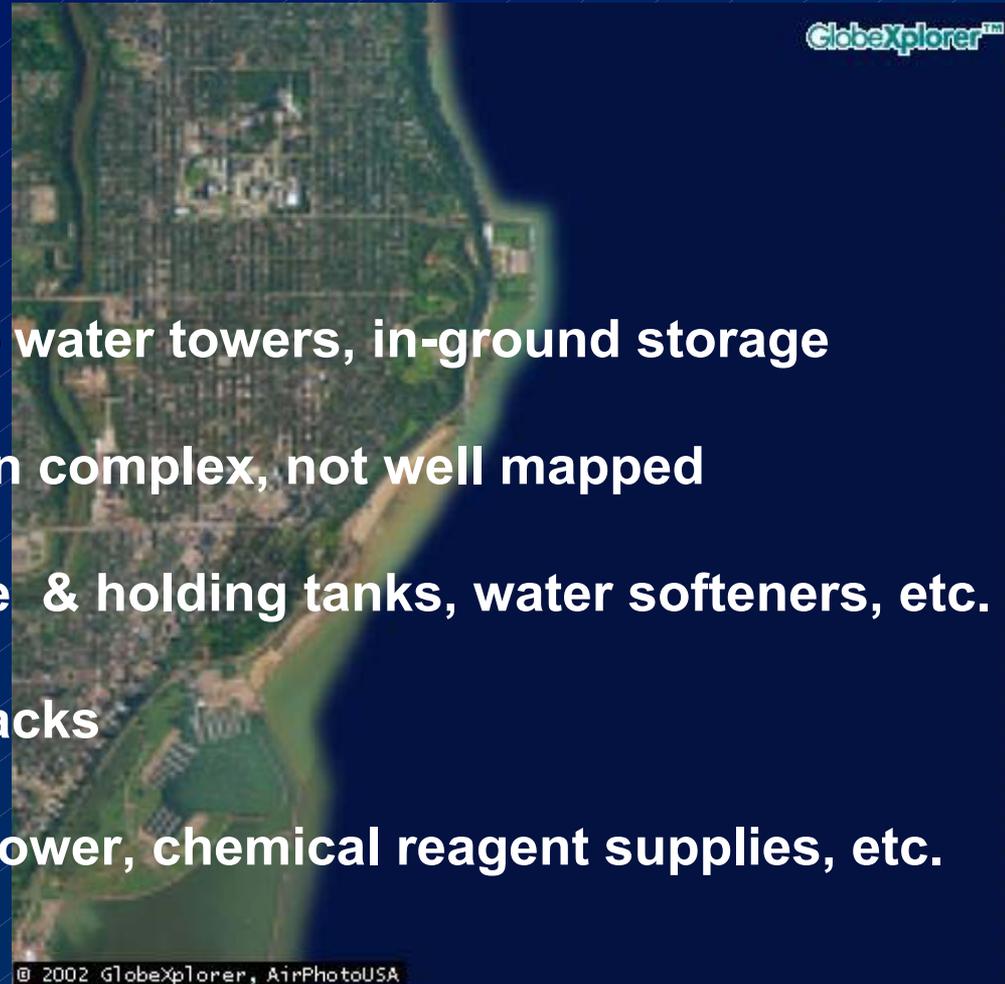
Unique national security aspects of GL freshwater supplies:

- >15 million people drink GL water
- largest potable water intake systems in the world – L. Mich
- susceptibility to biological and chemical contamination
- infrastructure vulnerabilities
- oceanographic in scale
- site of largest waterborne disease outbreak in U.S. history

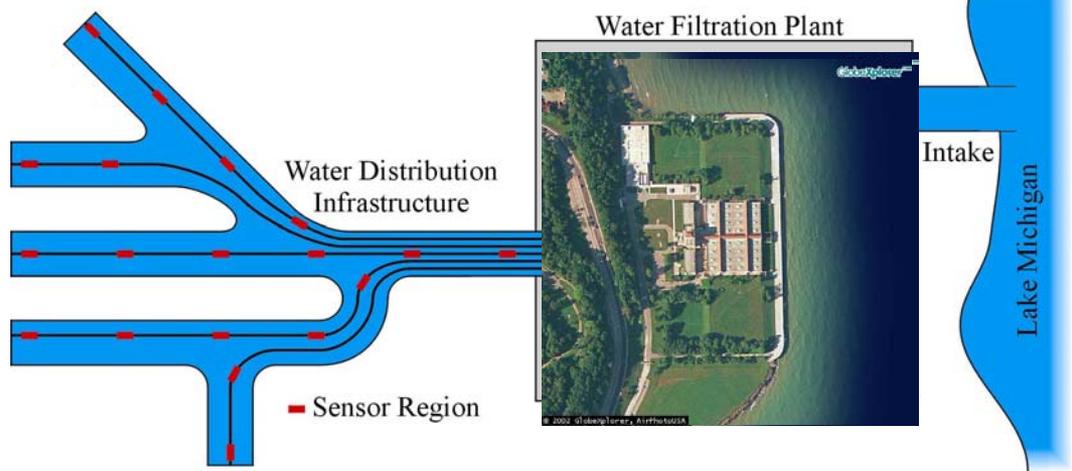
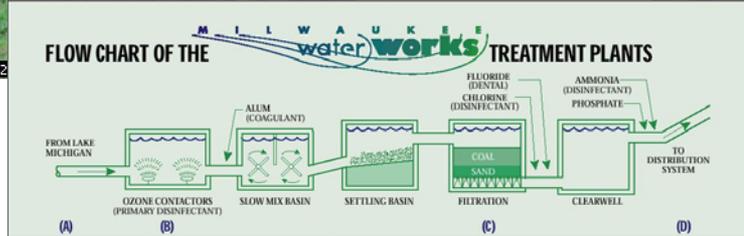


Water supply systems – pts of vulnerability:

- **source waters – intakes**
- **treatment facilities**
- **storage/reservoir systems – water towers, in-ground storage**
- **distribution networks – often complex, not well mapped**
- **building systems – pressure & holding tanks, water softeners, etc.**
- **control systems – cyber attacks**
- **interdependent systems – power, chemical reagent supplies, etc.**



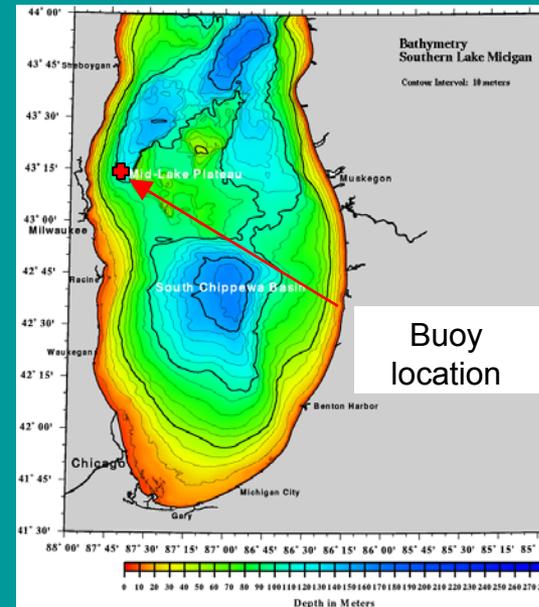
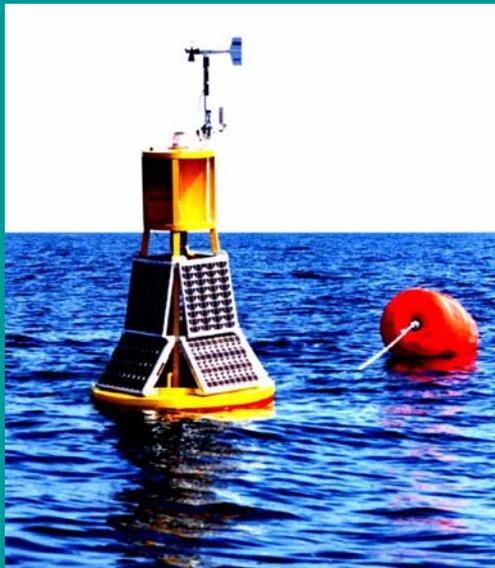
Instrumented Ecosystems



Challenge: Observation of high resolution temporal and spatial scale dynamics; Delineation of ecosystem variability from long term ecosystem change

Concept: “*Instrumented Ecosystems*” – remote sensing via a diverse array of sensors capable of telemetering data in near real time

Design: *A Great Lakes Observatory Network*
– Sea Grant, NURP & GLERL





www.uwm.edu/Dept/GLWI